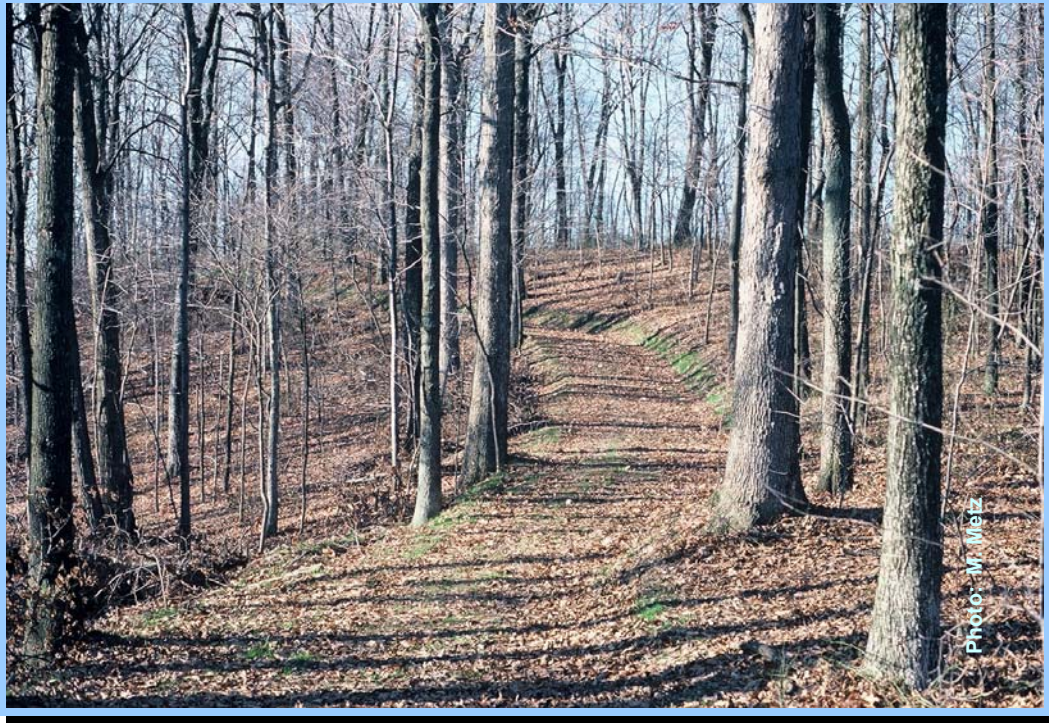


Forest Trails and Landings

WV Conservation Practice Job Sheet

Code 655



DEFINITION

A temporary or infrequently used route, path or cleared area within a forest.

PURPOSE

- Provide infrequent access to forest stands for management activities including fire suppression.
- Provide periodic access for removal and collection of forest products.

CONDITIONS WHERE PRACTICE APPLIES

Trails and landings are applicable on forested areas. Refer to the standard for Access Road, code 560, for travel-ways that will be designed and used frequently or repeatedly for vehicular traffic.

CRITERIA

Trails and landings will be of a size, gradient, number and location to accomplish the intended purpose.

They shall be located to minimize adverse onsite and off-site impacts such as accelerated erosion, riparian area and/or water quality degradation, stream channel and streambank damage, hydrology modification, aesthetics or unacceptable damage to advance regeneration, residual growing stock or wildlife habitat.

Timing and use of equipment will be commensurate with site and soil conditions to maintain site productivity and minimize soil erosion, displacement and compaction.

Slash, debris and vegetative material left on the site after construction will not present an unacceptable fire or pest hazard or interfere with the intended purpose.

Drainage and erosion control measures for trails shall be used and located to minimize water flows and erosion rates to acceptable levels.

Water bars, broad-based dips, and other drainage measures for trails shall be of sufficient size, intervals and gradient for adequate drainage and erosion control.

Trails and landings shall be revegetated to control erosion as needed. See conservation practice standards for Critical Area Planting, code 342 and Mulching, code 484. Locally invasive and noxious plants will not be used for revegetation.

Measures, including the use and treatment of equipment, will be used to control or protect against locally invasive species. If pesticides are used, refer to the Standard Pest Management, 595.

At a minimum, comply with applicable federal, state and local laws and regulations during the installation, operation and maintenance of this practice. See Field Office Technical Guide Reference - Best Management Practices for Controlling Soil Erosion and Sedimentation from Logging Operations in West Virginia.

<http://www.wvforestry.com/BMP%20Book%20Complete.pdf>

In 1992, the West Virginia Legislature passed the Logging Sediment Control Act (LSCA). This law sets forth requirements that loggers are to follow to minimize sedimentation and soil erosion. The law also requires that all logging operations be registered and supervised by a person who has completed training with the West Virginia Division of Forestry (WVDof).

BEFORE A LOGGING OPERATION BEGINS, AN OPERATOR MUST:

- Obtain a timbering license from the WVDOF
- Obtain logger certification by completing the WVDOF training program
- File a timbering operation notification with the WVDOF
- Post the operation with a sign consisting of the logging company name and timbering license number. Lettering on the sign must be at least 3 inches high

AN OPERATOR MUST ALSO:

- Notify WVDOF if you temporarily stop operating or finish a job 7 days or more prior to predicted finish date
- Reclaim the job within 7 days of completion. If reclamation cannot be done within 7 days of completion, notify WVDOF

Best Management Practices

The harvesting of timber has only a small short-term impact on forest streams and long-term site productivity if the skid trails, truck haul roads, and landings are well planned and properly constructed. However, if road systems are not carefully located and constructed, erosion will occur, streams can be polluted, and long-term site productivity is jeopardized. West Virginia has established timber harvesting guidelines, commonly referred to as Best Management Practices (BMPs). These guidelines help to:

- control erosion on disturbed areas,
- minimize the amount of eroded soil material entering forest streams,
- protect the habitat of aquatic life, and
- ensure good stewardship and long-term site productivity.

These common sense soil and water conservation measures control water so that erosion is minimized and water quality and site productivity are protected. BMPs incorporate five basic principles:

1 - PLAN THE JOB

Time spent planning and laying out roads, trails, and landings will prevent future problems. Careful planning allows you to fit the road to the land and keep grades moderate. Truck haul roads should be constructed under a 10% grade where possible. Grades up to 15% should be no more than 200 feet. Grades on skid trails should not exceed 15%, with the exception of short, steep distances not exceeding 20%. Use soils, topographic, aerial, conservation plan maps, and field reconnaissance to assist in preliminary layout. Southern exposures are generally best.

2 - STAY AWAY FROM STREAMS

Try to plan and build roads and landings at least 100 feet from streams. Keep equipment out of streams. Leave a strip of vegetation along streambanks to filter out eroded soil particles.

3 - USE CARE WHEN CROSSING STREAMS

When a stream must be crossed, use a culvert, bridge, or well-built ford. Cross the stream at right angles.

4 - CONTROL WATER IN SMALL AMOUNTS

Use ditches, culverts, broad-based dips, and grade breaks to handle water before it reaches destructive forces. Maintain drainage structures during and after logging.

5 - RETIRE ROADS AFTER LOGGING

Drain, grade and seed roads and landings as soon as possible. Limit access between December and April to prevent road damage.



CONSIDERATIONS

Assure safe ingress and egress to site.

Locate landings and trails to preserve aesthetic qualities.

Landings and trails may be used for wildlife food and cover plantings.

Favor native species for revegetating trails and landings.

Landings and trails may be utilized as firebreaks.

Consider cultural resources and environmental concerns such as threatened and endangered species of plants and animals, natural areas and wetlands.

Landings and trails may be closed for erosion control, safety and liability, and reduced maintenance costs.

Landings and trails may be utilized as firebreaks.

Consider species for revegetation which benefit wildlife.

OPERATION AND MAINTENANCE

Periodic inspections of landings and trails will be conducted and where necessary repairs will be made.

Landings and trails utilized as firebreaks will be properly maintained to accomplish this purpose.

Landings and trails may be closed for erosion control, safety and liability, and reduced maintenance costs. Refer to the standard Use Exclusion, code 472.

Traffic control is recommended to prevent road damage especially between December and April.

Landings and trails no longer needed, and not used as a firebreak, can be retired by removing high maintenance structures, such as culverts and bridges, and can be restored to a vegetative cover by planting and seeding.

Mowing helps to maintain grass cover and prevents vegetation from crowding roadways.

PLANS AND SPECIFICATIONS

Site-specific requirements for installing this practice are listed on the following pages of this job sheet. Specifications are prepared in accordance with the NRCS Field Office Technical Guide. See the WV conservation practice standard for Forest Trails and Landings, code 655, for specific requirements. Clients should work closely with NRCS and West Virginia Division of Forestry personnel when planning and installing this practice.

Specifications for revegetation of landings and trails should include species, timing and method of application. See WV Job Sheets for Critical Area Planting, code 342 and Mulching, code 484.

Forest Trails and Landings – WV Job Sheet

Client:	Farm #:
Field(s):	Tract #:
Designed By:	Location:
Date:	Total Acres of Forest Trails and Landings:

Purpose	
<input type="checkbox"/> Provide infrequent access to forest stands for management activities including fire suppression.	<input type="checkbox"/> Provide periodic access for removal and collection of forest products.

Truck Haul Roads (complete as appropriate)	
<p>Length of Truck Haul Roads:</p> <p>_____ Feet</p> <p>Minimum Width of Road: There should be a minimum road surface width of 12 feet on the cut surface.</p> <p>Minimum road surface widths of 16 feet should be used on all curves, and on areas of substantial cut and fill. Anticipated equipment use should be considered when determining road widths. An additional four feet of road width will be required when ditching and water disposal is necessary.</p> <p>Average Width of Truck Haul Roads:</p> <p>_____ Feet</p> <p>Total Acres of Truck Haul Roads:</p> <p>_____ Acres</p>	<p>Grade of Truck Haul Roads: Final center line grade of truck haul roads should be 10% or less. Final center line road gradients not exceeding 15% are permissible for distances up to 200 feet. By breaking or changing grade frequently, less erosion problems will be encountered than on long straight continuous grades.</p> <p>Stream Crossings: Streams should be crossed as close to a right angle to the stream as possible. Approaches to the stream should be graveled for a distance of 100 feet on each side. Bridges or culverts should be sized so as not to impede stream flow. Stream fords are permissible only when the stream bottom is rock based and can support truck traffic.</p> <p>Road gradients approaching water crossings should be broken and surface water dispersed so it will not flow directly into the stream. Roads should be located, with the exception of stream crossings, a minimum of 100 feet or more from perennial or intermittent streams and 25 feet from ephemeral streams. Distance is measured from the streambank to the bottom of the soil disturbance, in case of fills, to the toe of the fill slope.</p> <p>Intersection with Public Roadways: Truck haul roads that intersect public roads should have gravel or other aggregate up to 200 feet to keep mud off the roadway. Check county Division of Highways requirements for entering public roads.</p>
<ul style="list-style-type: none"> • All cut and fill slopes with a vertical height greater than 3 feet shall have side slopes that are stable for the soil material involved. In most instances, the following is required: soil 1.5:1, shale 1:1, rock 1/2:1. In some instances rock, trees and large roots will prohibit sloping, but provide stability for the bank. • Roads may be out-sloped for cross drainage. On side hills where a berm is necessary to protect the fill slope, the road should be in-sloped with cross drainage installed from the inside toe of the slope to the outside or downhill side. • Level areas where drainage is difficult to establish and wet soils should be avoided for road location if possible. • During construction adequate drainage of the road surface using temporary cross drains or water bars on a day-to-day basis is desired in the event of storm flows prior to road completion and installation of a permanent drainage system. • During the harvest operation, roads and their attendant drainage systems should be maintained to perform to standard. • Operations that will cause erosion and sediment should not be carried on in times of extreme weather conditions. • If roads are to be used after logging, broad-based dips, culverts and bridges should be left intact and be periodically inspected and maintained by the landowner. If not used, drainage structures should be removed and road surfaces restored to a natural drainage by out-sloping smoothly at 3%, leaving existing dips and establishing water bars. Stream banks will be least disturbed if bridge abutments are left intact when bridges are removed. 	

Skid Roads and Trails (complete as appropriate)

Length of Skid Roads and Trails:

_____ Feet

Minimum Width of Skid Roads and Trails:

_____ Feet

Average Spacing of Skid Roads and Trails:

Average skid road spacing should be about 200 feet apart.

Total Acres of Skid Roads and Trails:

_____ Acres

Grade of Skid Roads and Trails: Gradients should not be steeper than 15%, with the exception of short, steep segments not exceeding 20%. Grades up to 40% are acceptable if no mineral soil is exposed.

Stream Crossings: Any skid road necessitating the crossing of a stream will require a bridge or culvert of acceptable design. Logs will not be skidded through any stream.

Approaches to stream crossings should be as near to right angles to the stream as possible.

- During logging, cross drainage, including turn-outs, water bars or grade breaks for dispersing surface water should be installed at least every 100 feet and maintained daily.
- Upon final completion of skidding on a road, the logger should stabilize and retire the road before any other skidding occurs. This should be done by first removing the outer berm and out-sloping and smoothing the skid road. Water bars should be installed as described above.

Log Landings (complete as appropriate)

- Adequate streamside management zones should be left between landings and streams – See Streamside Management Zone Requirements below.
- Landings should be located on dry, firm sites and have a slight slope for drainage. Keep landing size to a minimum.
- Provide adequate drainage on approach roads so that road drainage does not enter the landing.
- Provide diversion around the uphill side of landings where seepage and lateral flow of water is a problem.
- When servicing equipment on site, drain old oil, etc., into containers and properly dispose of properly. All empty containers should be removed and disposed of properly.
- Seed and mulch landings immediately following completion of operations or use of the landing.

Number of Landings: _____

Average Length of Landings: _____ Feet

Total Acres in Landings: _____ Acres

Average Width of Landings: _____ Feet

Streamside Management Zones

Streamside Management Zones are vegetated land adjacent to perennial, intermittent and ephemeral streams and ponds or lakes requiring special attention during forestry operations. These are critical areas where non-point source pollutants can enter aquatic systems. An area of undisturbed forest soil between areas disturbed to mineral soil and a water body. It provides a protective zone to trap and filter out suspended sediments before these particles reach the water body. Any forestry operations should establish or enhance the riparian area while meeting landowner objectives.

Streamside management zones should be maintained among all streams, water courses, truck haul roads, skid roads and landings where soil has been exposed and surface runoff will carry sediment loads. Adequate streamside management zones should be maintained around all lakes or ponds, perennial flowing springs and all springs and reservoirs serving as a domestic water supply.

Streamside Management Zones (SMZ)



Stream	Stream	SMZ's	Log Haul
Bed	Bank		Road

On perennial and intermittent streams, 100' wide; on ephemeral stream flows, 25' wide.

Streamside Management Zone Continued- Design Criteria

- Streamside management zones should be at least 100 feet wide on each side of perennial or intermittent streams and 25 feet wide on each side of ephemeral streams.
- The streamside management zone should be protected to prevent exposure of mineral soil and subsequent erosion. Equipment operation in this area should be limited, however, cutting and pulling trees from this area is permitted. If mineral soil is exposed, it will be stabilized by seeding and mulching as soon as possible.
- Log landings will be located outside the streamside management zone where practical. If circumstances prevent this, then the landing will be treated as a critical area.
- Log landing fill areas within the streamside management zone will be seeded and mulched immediately after construction.
- Truck roads and skid trails should not be within the streamside management zone except when entering and leaving stream crossings. Streams should be crossed at right angles.
- Truck haul roads built, under certain circumstances, within a streamside management zone should be graveled and fill slopes seeded and mulched immediately after construction.
- Existing roads within the streamside management zone can be utilized only if using them will cause less damage than constructing a new road. Existing roads will be maintained in accordance with all requirements of truck haul and skid roads that reduce soil erosion and sedimentation.
- Recommended installation and spacing of drainage structures, such as culverts, water bars and broad-based dips should be used on truck haul and skid roads to intercept and properly discharge runoff in small quantities so the filter capacity within the streamside management zone will not be exceeded.
- Directional felling should be used to minimize stream disturbance. Felled tops in streams will be pulled from the stream channel on all perennial and intermittent streams. Small logging debris can be harmful to the stream channel causing bank erosion and channel blockage. It is also recognized that large woody debris in stream channels can be beneficial to wildlife.

Shade Strips

Shade Strips are no-cut or light-cut areas that provide adequate shading of perennial or intermittent streams so as to stabilize and preserve the biological value of the stream.

_____ Acres of Streamside Management Zones needed – See plan map for location

_____ Acres of Shade Strips needed – See plan map for location

Broad-based Drainage Dips

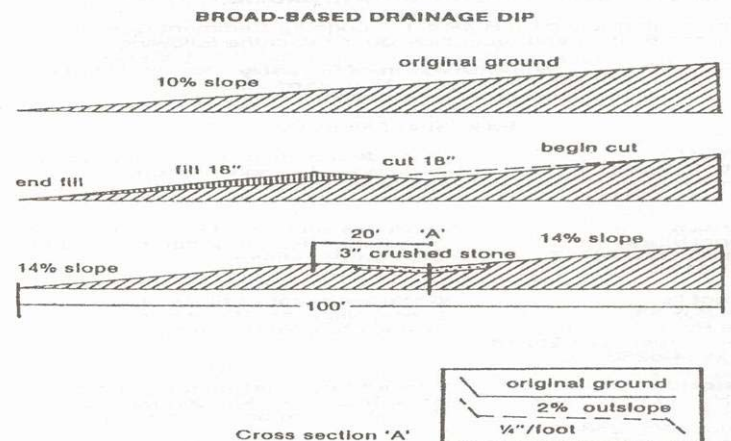
A broad-based drainage dip is a dip and reverse slope in a road surface with an out-slope in the dip for natural cross drainage. It is used to provide cross drainage on in-slope truck roads to prevent buildup of excessive surface runoff and sheet and rill erosion.

Broad-based dips can be used on truck and haul and heavily used skid roads having a slope of 10% or less. They are not to be used for cross draining intermittent or live streams.

Design Criteria

- Installation takes place following basic roadbed construction.
- A 20-foot, 3% reverse grade is constructed into the existing roadbed by cutting from upgrade of the dip location and using cut material for the reverse grade.
- Spacing of broad-based dips should be approximately 100 feet apart but never exceed 150 feet apart.
- Cross drain outslope will be 2-3% maximum.
- Use rip-rap to control erosion on the loose fill below the dip as needed.
- The dip and reverse grade section will require bedding with 20 ton of 3-inch crushed stone to avoid rutting of the road surface.

_____ Broad-based dips are needed – See plan map for location

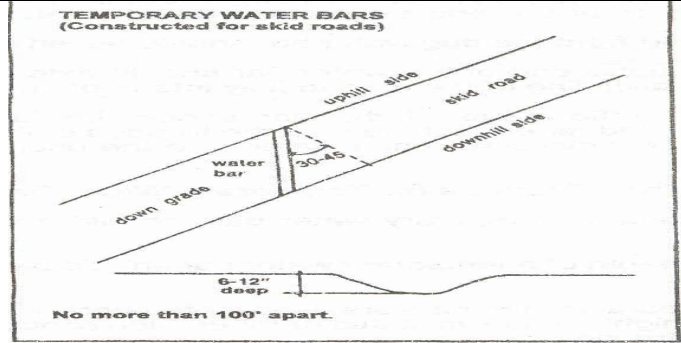


Water Bars (complete as appropriate)

Water bars are water control structures constructed across a skid road (30° to 45°), usually from soil, to intercept and divert water from the road surface. Water bars can be used where surface water runoff may cause erosion of the exposed road.

Design Criteria for Temporary Water Bars

- Temporary water bars are usually constructed at least 6 inches to one foot in depth.
- Spacing between temporary water bars should not exceed 100 feet.
- Temporary water bars are used for temporary shutdown, for overnight shutdown or for erosion control during road construction.



Design Criteria for Permanent Water Bars

- Permanent water bars are usually constructed at least one foot to 30 inches in depth.
- Proper spacing between permanent water bars can be determined from the following table:
- Installation should be at an angle of 30°-45° down slope or more to turn surface water off the road.
- A shallow trench should be dug one foot below the surface of the road and extend beyond both sides.
- Fill dirt from the dug water bar should be left intact.
- The uphill end of the water bar should extend beyond the side ditch line of the road to fully intercept ditch flows.
- The outflow end of the water bar should be fully open and extend far enough beyond the fill edge of the road to safely disperse runoff water onto the undisturbed forest floor.

Spacing to Use Between Permanent Water Bars

% Road Grade	Distance Between Permanent Water Bars (feet)
Less than 10%	100
10-20	50
20-30	40

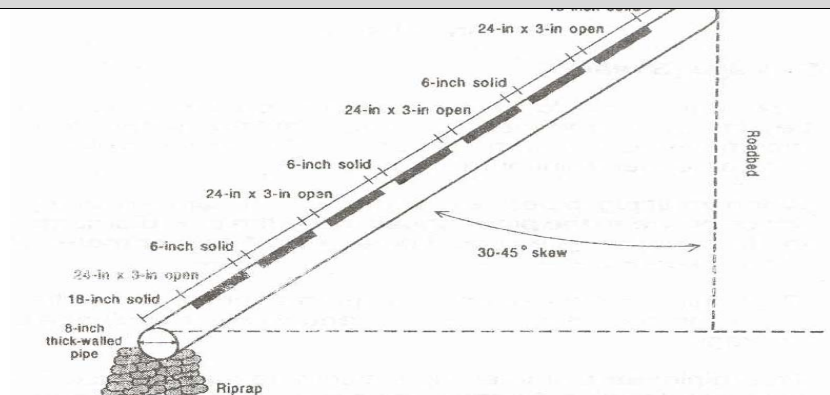
_____ Temporary water bars are needed – See plan map for location

_____ Permanent water bars are needed – See plan map for location

Open-top Pipe Culvert (complete as appropriate)

This is an 8-10 inch steel wall pipe with 3 inch wide slots cut 24 inch long along the pipe. They are used to intercept water on roads exceeding 10% slope where broad-based dips are impractical. Recommended spacing is at least 100 feet apart, but not more than 150 feet apart.

_____ Open-top pipe culverts are needed
– See plan map for location



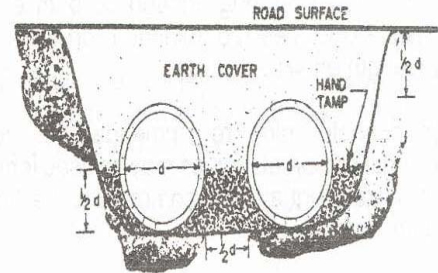
Pipe Culvert (complete as appropriate)

A pipe is a corrugated metal pipe or other suitable material that is placed under truck haul or skid roads to collect and transmit water flows from side ditches, seeps or streams under roads safely without eroding the drainage system or road surface. Pipe culverts can be used for any size operation where cross drainage of storm water or diversion of small streams is needed for truck haul or skid roads. In such cases, it is a necessary drainage structure for temporary operations, but can be permanent.

Cross Drainage - Streams - Design Criteria

- Pipe length should be long enough so both ends extend beyond side slope toes. On truck haul roads, the minimum recommended length is 25 feet. On skid roads, the recommended minimum width is 20 feet.
- When multiple pipes are used in a stream crossing, the space between the pipes should be $\frac{1}{2}$ the pipe diameter, and fill over the pipe should be 1 foot or more. Culvert size must be increased on multiple pipe installations. For example, two 18-inch culverts are required to carry the flow of one 24-inch culvert, two 36-inch culverts will handle the flow of one 48-inch culvert.
- The minimum pipe diameter recommended for use is 15 inches, however 18 inch diameter pipe is recommended. Smaller diameter pipes may be used temporarily as long as they are adequate to accommodate the stream channel at maximum flow. Note: When pipe diameter smaller than 15 inches is used, frequent clean-out maintenance is necessary.
- Pipe and stream gradient should be the same, with the pipe alignment being the same as the stream course.
- The minimum diameter pipe on permanent pipe installations should be according to the following table:

Multiple Pipe Culvert Installation



Estimated culvert diameter needed to carry flood water from forested areas ranging from 10 to 400 acres and recurrence intervals of 10 to 50 years. Accuracy of values for areas exceeding 100 acres is uncertain. Land use disturbance and soil type above culvert locations can affect water flow peak levels and therefore should be considered when using this chart. Areas with heavy clay soils may require larger diameter pipes if used as a permanent structure. For temporary culvert installations, the pipe diameter should be adequate to serve the water channel or ditch channel at maximum flow.

Area (acres)	10-Year Recurrence Interval (inches)	20-Year Recurrence Interval (inches)	50-Year Recurrence Interval (inches)
2-8	15	15	15
10	16	16	18
20	18	18	20
30	18	20	24
40	20	22	26
50	22	24	28
60	22	24	28
70	24	26	30
80	24	26	30
90	24	28	32
100	26	28	34
125	28	30	36
150	28	32	38
175	30	34	40
200	32	36	42
250	34	38	46
300	36	40	48
350	38	42	54
400	40	48	54

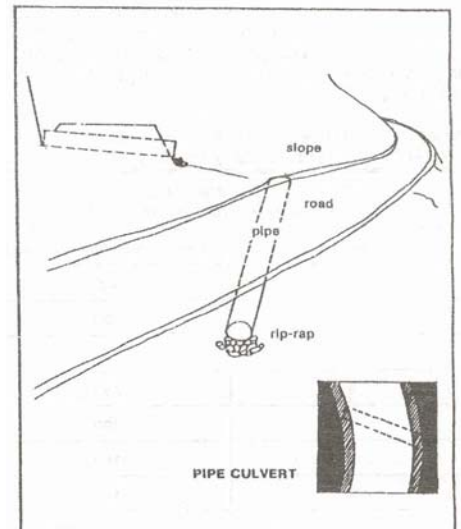
Table modified from: Helvey, J. David, and Kochenderfer, James N., 1988. Culvert Sizes Needed for Small Drainage Areas in Central Appalachians. USDA Forest Service, Northeastern Forest Experiment Station, Parsons, WV.

Cross Drainage - Ditching - Design Criteria

- Pipe length should be long enough so both ends extend beyond side slope toes (25 feet minimum length on truck haul roads; 20 feet minimum length on skid roads).
- Minimum diameter recommended for use is 15 inches; however, smaller diameter pipes may be used temporarily as long as they are adequate to accommodate the ditch channel at maximum flow. Note: When pipe diameter smaller than 15 inches is used, frequent clean-out maintenance is necessary.
- For use in disposing of collected surface water drainage, the culvert gradient should match the contributing ditch.
- Installation should be skewed 30-45 degrees downgrade.
- Protection should be provided for outflows of culverts to minimize erosion below the lower end of the culvert. It may also be needed on the upstream ends of culverts on flowing streams. This protection can be in the form of rip-rap or plastic filter cloth and rip-rap, large stone, hay or straw bales, etc.

Culvert Spacing Guide for Cross Drainage (Ditching)(Cont.)

Road Grade (%)	Metal Culvert Spacing (Feet)
2-10	200
12	150
14	100
16	50



Cross Drainage – Streams

_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

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Cross Drainage – Ditching

_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

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_____ Pipe culverts (_____ inches in diameter _____ feet long) are needed – See plan map for location

Seeding and Mulching - Specifications for revegetation of landings, roads and trails should include species, timing and method of application. See WV Job Sheets for Critical Area Planting, code 342 and Mulching, code 484.

Use Exclusion – Specifications for controlling access to the Forest Trails and Landings should include method and timing. See WV Job Sheet for Use Exclusion, code 472.

Forest Trails and Landings – WV Job Sheet

Additional Specifications and Notes:

Operation and Maintenance

Periodic inspections of landings and trails will be conducted and where necessary repairs will be made. Landings and trails utilized as firebreaks will be properly maintained to accomplish this purpose. Landings and trails may be closed for erosion control, safety and liability, and reduced maintenance costs. Landings and trails no longer needed can be “put to bed” by removing high maintenance structures, such as culverts and bridges, and can be restored to a vegetative cover by planting and seeding. Traffic control is recommended to prevent road damage especially between December and April. Mowing helps to maintain grass cover and prevents vegetation from crowding roadways.

Additional requirements:

If needed, an aerial view or a side view of the practice can be shown below. Other relevant information, complementary practices and measures, and additional specifications may be included.

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Questions regarding the planning, installation or maintenance of the Forest Trails and Landings should be directed to:

_____ at _____

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This job sheet was prepared by Barbara McWhorter, NRCS Forester, WV RPF #335